DRAFT
Rationale For Proposed Revisions To Ambient Water Quality pH Beneficial Use Standards

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RATIONALE FOR PROPOSED REVISIONS TO AMBIENT WATER QUALITY pH BENEFICIAL USE STANDARDS

Background

From a chemistry perspective, the term pH is used to denote the hydrogen ion (H^+) content of an aqueous solution. The pH of natural waters is a measure of the acid-base equilibrium attained by various dissolved compounds, salts, and gases. The reaction of dissolved carbon dioxide with water is one of the most important in establishing pH in natural water systems and is represented by the following steps:

Step 1 $CO_{2\,(aq)} + H_2O \leftrightarrow H_2CO_{3(aq)}$

Step 2 $H_2CO_{3(aq)} \leftrightarrow H^+ + HCO_3^-$

Step 3 $HCO_3^- \leftrightarrow H^+ + CO_3^{2-}$

Both the second and third steps produce H^+ which can influence the pH of the water. Chemical variables such as temperature changes and biological processes such as algal growth and decay can affect the interactions and kinetics of the carbonate-water system. Fluctuations in the temperature of a waterbody cause a corresponding change in the pH of the system. Plant photosynthetic activity during the daylight hours tends to increase the pH as CO_2 is removed from the system. At night, pH will decrease as CO_2 is released through algal decay. Reactions between water and solid species – hydrolysis reactions – remove H^+ ions from solution, thus raising the pH. Other reactions involving formation of precipitates or oxidation of mineral compounds influence the pH by generating H^+ ions, thereby lowering the pH.

pH is an important parameter in evaluating the chemistry of natural waters. The degree of dissociation of weak acids and bases and the solubility of metal compounds are affected by the pH of the water. This effect is important because the toxicity of many compounds is influenced by the degree of dissociation while the mobility and corresponding environmental fate of many metals and toxic compounds is determined by the corresponding pH of the waterbody. For example, the toxicity of cyanide and hydrogen sulfide to fish increases as pH is lowered. Conversely, ammonia has been shown to be more toxic to aquatic life at higher pH values.

Proposed Revisions to Water Quality pH Beneficial Use Standards

For major waterbodies in Nevada, site-specific water quality standards have been developed based on the designated beneficial use of the waterbodies. Generally, beneficial use standards are derived from criteria and guidance established by EPA. The water quality standards are established to protect the beneficial use, which is most sensitive with respect to that particular standard.

The pH beneficial use standards (BUS) contained in the Nevada water quality standards for designated waterbodies, Nevada Administrative Code (NAC) 445A.146 to 445A.225, were established for protection of wildlife, aquatic life, and water contact recreation. When the water quality standards were originally developed, the pH BUS ranges recommended by the EPA in the Blue Book Water Quality Criteria (1972) were used. The recommended pH levels were 7.0 to 8.3 standard units (SU) for protection of wildlife and water contact recreation, and 7.0 to 9.0 SU for protection of wildlife and aquatic life.

EPA's most recent criteria for water quality standards, the Gold Book Quality Criteria for Water (1986), recommends a pH range of 6.5 to 9.0 SU for the protection of aquatic life. Based on information contained in the Gold Book, a pH range of 6.5 to 9.0 will provide adequate protection for the life of freshwater fish and bottom dwelling invertebrates. It appears that this pH range will also be protective of other beneficial uses including recreational activities involving water contact and propagation of wildlife

NDEP proposes to amend the pH BUS range to 6.5 to 9.0 SU in the Nevada water quality standards to comply with the most recent EPA recommended criteria. During recent water quality standard reviews for the Truckee, Carson, Humboldt, Walker and Snake River Basins, and Las Vegas Wash-Lake Mead, the pH criteria of 6.5 to 9.0 SU has already been adopted in the water quality regulations for these waterbodies.

At this time, NDEP is not proposing to revise the water quality criteria in the Class Waters standards (NAC 445A.123 through NAC 445A.127) or in the Lake Tahoe and tributaries water quality standards (NAC 445A.191 and NAC 445A.1915). The Class Waters are currently being reviewed by NDEP. Appropriate changes to the pH water quality parameters for these waters will be made when the Class Waters standards are assessed as part of NDEP's triennial review schedule of established water quality standards.

NDEP in conjunction with the Lahontan Regional Water Quality Control Board (LRWQCB) is currently evaluating the Lake Tahoe water quality standards. Proposed revisions to the lake's water quality criteria will be a joint effort between both agencies.

The waterbodies that need to be updated to reflect EPA's most recent recommended pH BUS water quality criteria are listed below. The specific waterbody or river system reach with its corresponding NAC regulation, the designated "most restrictive" beneficial uses, and the proposed revision of the pH water quality standard are listed.

NAC 445A.158 Carson River at Lahontan Dam

Beneficial Uses: Wildlife Propagation, Water Contact Recreation

Replace pH S.V. Standard of 7.0 – 8.3 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.171 Chiatovich Creek

Beneficial Uses: Wildlife Propagation, Water Contact Recreation

Replace pH S.V. Standard of 7.0 – 8.3 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.172 Indian Creek

Beneficial Uses: Wildlife Propagation, Water Contact Recreation

Replace pH S.V. Standard of 7.0 – 8.3 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.173 Leidy Creek

Beneficial Uses: Wildlife Propagation, Water Contact Recreation

Replace pH S.V. Standard of 7.0 – 8.3 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.175 Virgin River at Mesquite

Beneficial Uses: Wildlife Propagation, Aquatic Life

Replace pH S.V. Standard of 7.0 – 9.0 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.176 Virgin River at Littlefield

Beneficial Uses: Wildlife Propagation, Aquatic Life

Replace pH S.V. Standard of 7.0 – 9.0 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.177 Virgin River at Riverside

Beneficial Uses: Wildlife Propagation, Aquatic Life

Replace pH S.V. Standard of 7.0 – 9.0 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.178 Beaver Dam Wash

Beneficial Uses: Wildlife Propagation, Water Contact Recreation

Replace pH S.V. Standard of 7.0 – 8.3 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.179 Snake Creek

Beneficial Uses: Wildlife Propagation, Water Contact Recreation

Replace pH S.V. Standard of 7.0 – 8.3 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.192 Colorado River below Davis Dam

Beneficial Uses: Wildlife Propagation, Water Contact Recreation

Replace pH S.V. Standard of 7.0 – 8.3 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.193 Colorado River below Hoover Dam

Beneficial Uses: Wildlife Propagation, Water Contact Recreation

Replace pH S.V. Standard of 7.0 – 8.3 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.210 Muddy River at Glendale

Beneficial Uses: Wildlife Propagation, Aquatic Life

Replace pH S.V. Standard of 7.0 – 9.0 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.211 Muddy River at Overton

Beneficial Uses: Wildlife Propagation, Aquatic Life

Replace pH S.V. Standard of 7.0 – 9.0 with pH S.V. Standard of 6.5 – 9.0

NAC 445A.212 Meadow Valley Wash

Beneficial Uses: Wildlife Propagation, Aquatic Life

Replace pH S.V. Standard of 7.0 – 9.0 with pH S.V. Standard of 6.5 – 9.0

Authorized tribes have independent authority for setting water quality standards and implementing regulations for waters on reservation lands under the 1987 Amendments to the Clean Water Act. At this time, the State of Nevada regulations include water quality standards for waterbodies on tribal lands throughout Nevada. However, the State of Nevada has no authority to set standards on tribal lands, therefore, the existing pH water quality standards contained in NAC 445A.168 (Walker River at Schurz Bridge), NAC 445A.190 (Truckee River at Pyramid Lake), and NAC 445A.224 (East Fork Owyhee River at the Nevada-Idaho stateline) are not proposed to be modified in this proposal.

Affect of Proposed Regulation Changes on Standards Compliance

The regulation changes proposed in this rationale document will not affect compliance with Nevada water quality standards. A review of the 1998 303(d) List indicated that the Walker River had been listed for exceedance of pH water quality standards. The impairment was due to the upper limit of the previous standard (7.0 to 8.3 SU) being exceeded. As mentioned above, the water quality standards for the Walker River basin have been recently reviewed and revised. The EPA recommended pH BUS range of 6.5 to 9.0 SU has been adopted in the water quality regulations for this river system. A cursory review of Walker River water quality data indicates compliance with the new proposed pH BUS standard. Since the other designated surface waters did not have previous pH criteria exceedances, it is not anticipated that the proposed revision of the pH BUS criteria for these waterbodies, which will involve broadening the pH water quality range, will affect standards compliance.